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No. 26

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Industrial Technology
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The use of country designators will be discontinued.

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ENERGY

GIRAUD OUTLINES FRANCE'S ENERGY POLICY TO 1990

Paris LE MATIN in French 3 Apr 80 p 5

> [Text] Andre Giraud hopes to reduce our dependence on oil to 33 percent as compared to 66 percent in 1973.
>
> Stopping oil imperialism, furthering the nuclear effort, prudent reevaluation of coal and imported gas, with, once more, bringing out alternative energies: such are the broad outlines of the redeployment of energy in France for the 1990 horizon. Yesterday Andre Giraud presented the details of these orientations to the Council of Ministers. The objectives are clear, even ambitious. But the resources for these new basics are less evident. Andre Giraud evaluates at 70 billion francs the annual investment the French plan will generate, the success of which depends on a general mobilization and which will open up a new era. The Socialist Party and the CFDT, however, are skeptical that the reign of king oil will be supplanted by nuclear power.

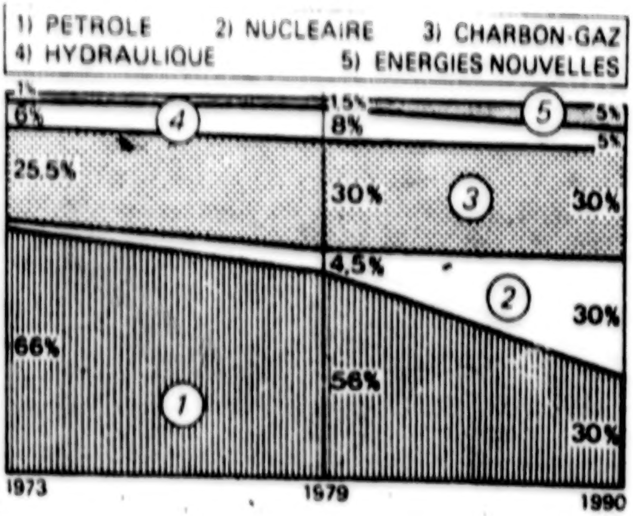
The government's energy gamble for the 1990 horizon is based on a hypothetical economic growth of 3.5 percent annually. It is committed to three major options: reduction of oil dependence to 33 percent (from 66 percent in 1973); pursuit of an electro-nuclear program at a sustained rate, which is to say the establishment of four 1,300 MW power stations each year; and putting into operation what Valery Giscard d'Estaing calls "sober growth," that is, while the French economy grows it will also consume 40 percent less energy than in the past.

In supposing that intensification of efforts to save energy that Andre Giraud figures at 60 million tons equivalent to petroleum (tep) in 1990 (triple that of 1979), France should then consume only 242 tep by the end of the 10 year period, as compared to 193.5 million in 1979. The energy use distribution, under the best hypothesis, thus breaks out in 1990 as: oil, 30 percent; nuclear, 30 percent; coal gas, 30 percent; alternative energy plus hydroelectric, 10 percent. From this it is seen that the intense effort in nuclear energies will result that in 10 years it will provide as much energy as imported oil, which as a corollary also supposes a strong push into electricity, especially after 1985.

To further fix this idea, in 1990 we will import only 68 million tons of oil as compared to 108.5 million last year, while nuclear plants will supply 75 million tep as compared to 8.5 million tep. The atom will replace oil, that is somewhat the definition of the "redeployment of energy" desired by Andre Giraud. But that's not all.

There is still coal, gas, and renewable energy sources such as hydroelectric. The Minister of Industry evaluates their part in the 1990 distribution, still in a "volunteerism" context, at 33 million tep for coal, 42 million tep for gas, 12 million tep for alternative energy sources, and 14 tep for hydroelectricity. As Andre Giraud explains, "we have had to take into account the inherent limitations of each of these energy sources." The limits of gas, as for oil, are dictated by the security of the suppliers. The minister, be it said in passing, does not seem to think this is a problem for uranium. As concerns coal, it is the international availability that must be considered. France is investing in foreign mining companies. "There must certainly be an honest inventory made of our national resources, look into gasification. But exploitation of national coal resources costs 2.3 billion francs overall, and is limited by the factors of exploitation."

Finally, renewable energy sources. Expansion of hydroelectricity is "subordinated to the possibilities of sites." Status quo, then. As for alternative energy sources; a wink to the ecologists, Andre Giraud is of the opinion that their development objectives are "ambitious": 10 to 12 million tep. He is waiting to know all the methods underway of "green energy": wood, biomass (7.5 to 9 million tep, to be added to savings in agriculture), solar heating (1.3 to 1.5 million tep), geothermal (0.8 to 1 million tep), micro-centrals (0.5 million tep). Concretely, this means 1.5 to 2 million housing units heated by wood in 1990, 2 million equipped with solar heating units for water, 1.5 million for solar energy, 800,000 with geothermal units.... "Some new techniques," the minister acknowledges, "will be conditional on the calendar of their technical development." And he cited as an example the project for redistributing the heat thrown off by some factories. The current parliamentary session must, according to him, vote on a legislative proposal furnishing a legal framework appropriate to this project.



Key:

1. Petroleum
2. Nuclear
3. Coal gas
4. Hydroelectric
5. Alternate energy sources

The above graph clearly indicates the replacement of oil by nuclear energy in the French energy profile from 1979 to 1990. The share held by coal and gas does not change much, while alternative energy sources appear up to a 5 percent level.

The Conditions for the Gamble

Industry

Divide the consumption of oil by 2.7. Change two boilers out of three.

Multiply the consumption of coal by 5.

Double the rate of penetration by electricity in relation to past years

Invest 60 billion francs to economize 6 million tep in existing installations.

In Housing Units and Offices

Improve insulation in new housing units and offices by 20 percent to 30 percent (saving 6 million tep).

Insulating 500,000 already existing housing units annually (saving 4 million tep).

Similar action for offices and other business premises (saving 2 million tep).

Increasing the use of coal through heating means already existing or to be created (saving 2.5 million tep).

Using alternate energy sources in 5 million housing units.

Transportation

Reduce consumption in new vehicles by 30 percent. The objective is 6 liters per 100 kilometers in 1990.

Develop ways of saving fuel in existing vehicles.

Electricity

Bring the rate of increasing consumption to 5.6 percent per year between 1980 and 1990 instead of the 6.5 percent between 1960 and 1980.

8860
CSO: 3102

ENERGY

FRANCE-MOROCCO COOPERATION IN ENERGY

Paris AFP SCIENCES in French 30 Apr 80 pp 5-6

[Text] France and Morocco have decided to increase their cooperation in the field of energy. Efforts now under way will be consolidated by a visit to Morocco in the coming months by the French minister of industry, Mr. André Giraud.

The bases of cooperation in this new field were established this week in Rabat during talks between a French delegation lead by the director general of energy and raw materials, Mr. Francois de Wissocq, and Moroccan leaders.

These talks complete the exchanges of views which King Hassan II, President Valery Giscard d'Estaing and Mr Giraud had this month on the occasion of the Moroccan sovereign's visit to France. They had been preceded by the visit to Paris of the Moroccan director general of energy, Mr Mohamed Adiki, last September.

Franco-Moroccan cooperation in the energy field will comprise three basic activities according to the Moroccan minister of energy and mines, Mr Moussa Saadi: oil research, the valorization of oil-shale and the production of electricity through the use of nuclear energy, coal or hydraulic sources.

Its basis, Mr Saadi affirms, will be the enormous natural potential which exists in Morocco. A potential which is greatly underutilized, since Morocco's energy dependence is 82 percent. (France's is 75 percent).

Where oil research is concerned, Morocco, in August 1979, signed with ELF Aquitaine an agreement covering 22,000 square kilometers of a most promising region, according to Mr Saadi's words, in the Gharb, the pre-Riff and the Atlantic off-shore.

Morocco now hopes to get France to "participate in a joint effort in the promise-filled area of developing oil-shale," of which it has huge reserves.

In this sector a third country also could be called on for cooperation, the Moroccan minister feels. For the large deposits in Timahdit in the central part of the country and those in Tarfaya along the Atlantic he envisages either the direct combustion of the oil-shales to supply central electric stations or the extraction of gas and oil by pyrolysis.

Morocco likewise hopes to get France to participate in the development of its electricity, particularly that of nuclear origin. For that it is counting on the uranium which will be extracted from phosphates of which it holds 75 percent of the world's reserves. The first Moroccan central nuclear station, Mr Saadi indicated, should begin production within 10 years. That is to say, its creation must be started "as soon as possible."

The uranium production will exceed Morocco's needs, and will therefore enable it to become an exporter. In this regard Mr Saadi stresses that only 3 years are needed to achieve a uranium production unit on the basis of phosphoric acid whereas it takes about 10 years to put a uranium mine into production.

Regardless of this, Morocco does not intend to neglect the production of electricity by means of coal (one-third at present) of which it possesses the only mine in utilization in the Arab world, nor by means of white coal, of which three-fourths of its potential are still unused.

Morocco is also counting on France to develop the utilization of renewable energy, resorting to the sun, the wind or the biomass (production of gas through the fermentation of agricultural wastes).

France could construct pilot installations in cooperation with the renewable energy center of Marrakech. These installations would serve as models for thousands of others to be disseminated afterwards throughout the country to promote rural development.

Finally, Morocco is bearing in mind French experience in the matter of saving energy. Moreover, a campaign is under way in the kingdom. Cooperation will, in addition, be strengthened in the area of training and adjusting mining legislation or that concerning energy and energy-saving.

"All this," the Moroccan minister of energy and mines affirms, "will take shape through well defined projects at the time of Mr Giraud's visit to Morocco."

9498
CSO: 3102

ENCOURAGEMENT OF SMALL FIRMS IN ALTERNATE-ENERGY INDUSTRY

Frankfurt/Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 9 May 80 p 5

[Text] Frankfurt, 8 May--After a short question from the CDU/CSU the Federal government has responded to a list of questions on the topic "New renewable energy sources" (Government Publication 8/3869). In the answer state expenditures for energy research in 1979 are given as DM 1.9 billion, of which 114 million were allocated to the use of renewable energy sources. According to government figures, funds for renewable energy sources in 1979 are broken down as follows.

	Millions of DM
Solar energy	57
Heat pumps	19
Wind	14
Geothermal energy	11
Biomass	10
Others	3
Total	114

Federal expenditures for research into renewable energy sources amount to 5.5 percent of general Federal funds for energy research. Besides the funds for research and development it is particularly in the area of renewable resources that the government believes the substantial measures taken to promote market introduction to be particularly significant. The Federal government would like to give greater opportunities for research and development contracts and for marketing new technology principally to small and medium-sized companies. In the government's view renewable energy sources require the use of small-scale technology, especially if they are to be used in the FRG. For this reason they would be interesting to small and medium-sized companies.

The principal recipient of promotional funds from the state is the capital goods industry, in particular the machine building industry and the electrotechnical industry. Within the program of investment in the future funds were also made available for the installation of solar units in government buildings. According to government statements care was taken to insure that small and medium-sized companies were appropriately involved both as manufacturers and installers of solar components and units. Spot checks show that under the investment program funds totaling DM 150 million for 140 individual projects have gone predominantly to the smaller and mid-sized companies.

However, there has been little success in the promotion of the use of new renewable energy sources as far as additional energy conservation or tax credits are concerned. Under the DM 4.35 billion program to promote investment in the conservation of heating energy, which runs until 1982, 90 percent of the applications for funds were for insulation and windows. A further 5 percent went for improvements to heating and hot water systems and only 5 percent for new technology and remote heat terminals. If the remote heat terminals are excluded, only a few percent of the funds for the investment-in-the-future program have gone to the area of the use of new renewable energy sources.

There are no precise findings about taxes. But it is highly likely that the same trend will be confirmed with respect to tax allowances as has been established with additional energy conservation. The Federal government does not pursue the international comparison of governmental funds for new energy sources in its answer since no specific question was asked about it. According to EEC date, the FRG is at best half-way up the list of comparable industrial countries in government expenditures for new energy sources.

9581
CSO: 3102

ENERGY

SOLAR ENERGY TEST PROGRAM REDUCED

Frankfurt/Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 8 May 80 p 7

[Text] Frankfurt, 7 May--In a broad, research-intensive demonstration project a few years ago the Federal Ministry for Research and Technology had considered funding the installation of solar energy units for heating purposes as part of the Federal Government's solar research program. At that time, the purpose of the assistance was to be the development of a nationwide monitoring program to gather data about the use of solar energy plants in the FRG, because this can only be achieved by an appropriately selected construction program across the individual regions of the FRG. On the basis of the data, which were to be gathered over several years, additional provisions for improvements were to be developed. In the meantime this broad program for testing solar units in single- and multiple-family dwellings has been dropped. In response to a question from deputy Dr Riesenhuber in parliament the following reasons were given:

1. There has been a rush in the development in the field of solar technology, particularly in solar water heating using flat collectors. Flat collectors currently represent the state of the art. According to the government, it is no longer necessary for it to become involved in financing research.

2. Through the 4.35 billion State/Land energy program grants for the installation of solar units were assured. So there was no longer any need for additional Federal funding.

3. Some 140 individual projects for solar units are being constructed in government buildings with government purchases running at DM 50 million. Of these 60 alone are being used through the Defense Ministry in housing for the Bundeswehr. On the average 10 such projects are distributed to each of the six Armed Forces Administrative Areas of the FRG, and the government feels that all the important regions of the FRG are covered.

4. Data gathered from the Federal purchases are being collected. In addition, there is a special program in Landstuhl in the Palatinate. Some 60 single family homes are being built there with provisions for passive and active use of solar energy.

According to the minister for research past developments show that in solar technolgy research and demonstration projects the most important thing is to ensure the greatest possible flexibility in view of rapid technological progress.

9315
CSO: 3102

ENERGY

FRAUENHOFER AMPLIFIES SOLAR ENERGY RESEARCH

Frankfurt-Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 3 May 80 p 5

[Text] Frauenhofer Society for the Advancement of Applied Research, Munich. The Frauenhofer Society wants to establish two new scientific institutes to increase the competitiveness of German industry. A Frauenhofer Institute for Transportation Technology and Product Distribution is to be built in Dortmund, and one in Freiburg for Solar Energy Systems. In this way the society would be creating the bases from which to carry out, in two increasingly important areas, direct contractual research for industry and application-oriented research with implications for the future.

Dr Heinz Keller, president of the society, believes that German industry could possibly save millions of marks annually through new techniques in transportation and distribution. On the average, transportation, packaging and distribution account for about 20 percent of the costs of industrial products today; it appears possible to reduce this to 15 percent. While modern techniques have made their way into the area of production, there is hardly any mastery of transportation and distribution systems: material flow technology was lagging behind in the introduction of microelectronics compared to production technology. Speed and the cost of goods transportation were becoming increasingly important due to increasing competition on the market.

The Frauenhofer Institute for Transportation Technology and Commodity Distribution will develop new instruments and plants as well as software systems for control and distribution. Customers for the research projects will come principally from industry. In contrast, the new Frauenhofer Institute for Solar Energy Systems will take on projects principally for the state. Here the emphasis will be primarily on the future. In the long term, says Keller, there will be only nuclear and solar energy to meet the high demand for electrical energy.

Keller is convinced that within 10 years decentralized solar energy systems will come on to the market which will be able not only to convert solar energy into electrical current, but also to store the energy gained and be economical as well. "There are enough storage systems that have not been investigated today to ensure that within a relatively short time we can count on having energy storage methods with five to ten times better performance than current ones." If this were to be successful, the plug-in automobile would not be a Utopia. Solar energy will be used not only in decentralized but also in major central power stations. Keller is working with a time span of 30 years. He thinks this is realistic because advances in solar technology can be realized more rapidly than in the development of the fast breeder or nuclear fusion.

In Keller's view solar energy is not just a matter of meeting the long-term needs of our rising energy requirements but also of securing a share in a giant new world market that will soon be here.

"If one uses as a comparison industries with an annual turnover of 100 to 150 billion marks, such as the auto, chemical and electrical industries--businesses that export 50 percent of their production--I do not consider it Utopian for a German solar energy industry to achieve comparable importance in 30 years."

The new Frauenhofer Institute for Solar Energy Systems will carry out research in four areas:

--Concentration of sunlight under conditions of indirect as well as direct radiation. The Frauenhofer Society already has considerable know-how in this area from its years of research in the Freiburg Institute for Applied Solid-State Physics.

--Conversion of solar energy into electrical and thermal energy. For example, developing new solar cells with an efficiency two to three times greater than that of cells in use today. Research by the Frauenhofer Society is already being carried out on:

--Energy storage and

--Control technology with the aid of microelectronics.

9581
CSO: 3102

CURRENT DEVELOPMENTS IN WIND-ENERGY TECHNOLOGY

Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German Mar 80 pp 83-84

[Text] The wind energy converter, which was developed and built by Dornier in Friedrichshafen using the Darrieus principle, has been undergoing tests since April of 1979 on the Schauinsland near Freiburg. The unit, consisting of a vertical, rotating axis and three attached, bent rotor blades (extruder profiles) was also subject to comprehensive wind chamber tests. This spring the unit will be installed on the North Sea island of Pellworm for additional tests. Wind energy units using the Darrieus propeller principle are characterized by a comparatively uncomplicated structural form facilitating their production as well as their use in developing countries. There they can be used with particular advantages for autarchic energy plants (up to 20kW) and pump motors.

Dornier is presently working on an advanced development of this principle as part of an international project of the Federal Ministry for Research and Technology (BMFT) for developing a 20 kW wind energy converter for Argentina.

The technical data of the prototype unit are as follows: blade diameter of 5.5 meters; total height of around 6.5 meters; number of blades is 2 to 4; electrical power of 1 kW at 6.5 m/s wind speed and around 70 $\cdot$ min^{-1}; permissible constant speed of 30 m/s with temporary gusts up to 45 m/s.

A new type of wind energy unit for 10 kW was put into operations in Schnittlingen/Stoetten on the Swabian Alb in December 1979 which was developed in the interests of efficiency as a modular system. A maximum number of industrially available series parts were installed. One exception is the two rotor blades made of fiber glass synthetics which only weigh 31 kg despite their length of 5.5 meters. The modular system also enables the simple replacement of individual machine elements and simple servicing. The 10 kW wind power unit was developed for 0.5 $\cdot$ 10^6 DM under contract of the Federal Ministry for Research and Technology by the German Research and Testing Institute for Air and Space Travel (DFVLR). The wind energy unit is considered a prototype for energy production in developing countries or for remote consumers.

This unit is especially designed to provide power to small consumers of power whereby the rated power is achieved at a relatively low wind speed of 8.5 m/s. The propeller with its two fiber glass rotor blades then rotates at 135 min^{-1}, a rotational frequency at which the rotor does not produce any more noise than a fast flying glider plane. Positioned upon a 10 meter high secured pole, the propeller, including the machine set, always turns automatically vertical to the wind as a result of a small pulley in order thereby always to achieve the most favorable power yields.

With increasing wind speeds, the power output of the wind energy system increases. Without a corresponding regulator, 8 times as much energy, namely 80 kW, can be provided with only a doubling of the wind speed from 8.5 m/s to 17 m/s. Because of the generator's design for assuming only 10 kW, a rapid acting regulator must maintain power inputs at roughly 8.5 m/s--this occurs by setting the rotor blades around their longitudinal axis.

Presently the power data of the unit are being ascertained exactly as a result of a series of comprehensive measurements. A subsequent simulation program is supposed to provide insights into the interaction of the unit with the various consumers for the energy produced. The testing grounds in Schnittlingen provide a very regular wind with an annual mean of 4.7 m/s. At these wind speeds, the DFVLR wind energy unit could provide around 22,000 kWh annually.

There is not, however, much interest in this wind energy system within the FRG but rather more so in countries that are thinly populated and therefore have individual consumers which are located at remote distances from each other (farms, remote villages, islands, etc.).

The Swedish government has commissioned the development of a wind energy unit which will be installed on Gotland and will receive a propeller having a diameter of 75 meters. The wind energy converter is supposed to provide 6,000 MWh annually with 2 MW.

The VFW Fokker, ERNO and AG-Weser firms in Bremen together with the Swedish Partner Karlstads Mekaniska Werkstand (KMW, Kristinehamn), which is responsible for the ducts, won the contract for this pilot project.

The unit is supposed to begin tests in December 1981 in the southwestern part of the Gotland Island. Thereafter the Swedish Electricity company Vattenfall will use the system and supply a portion of Gotland with electricity from the wind energy unit after April 1982. If there is sufficient evidence for the utility of wind energy after 2 years of testing, then the Swedish government wants to come to a decision on the use of wind power plants on a large scale. A second wind power plant is being built in southern Sweden near Trelleborg by a dockyard which was also commissioned by the Swedish government. This plant should also begin operations in 1982.

9527
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ITALY'S ENDOGENOUS POWER SUPPLY REVIEWED

Rome SCIENZA & VITA NUOVA in Italian Jan 80 pp 27-31

[Article by Piero Piazzano: "Oil--Little; Methane--Little; Let's Console Ourselves With Hot Water"]

[Text] "The moment has come to say that Italy is getting ready to become, among the industrial nations of Europe and even of the world, one of the strongest producers of energy--more precisely, of electrical energy--and no words are needed to explain what a potent factor of wealth and collective well-being a fact of this kind can be.

"This energy will not be obtained from waterfalls or from power plants in which coal or naphtha is burned, as is done today; nor will it come from plants kept in motion by the silent force of methane, the most recent product of our subsoil. Rather, it will spring out of the earth itself, the earth that we wrongly always regarded as a cruel stepmother and who today is preparing to give us a gift of the greatest importance.

"The SIFE--the Italian Endogenous Forces Company--is being set up in Italy, with the participation of AGIP [National Italian Oil Company], the State Railways and the IRI [Industrial Reconstruction Institute]: practically speaking, therefore, the state, with its biggest organisms. SIFE's program is to drill, in 4 years, 100 wells all over Italy, designed to tap from underground the very same tremendous forces that feed the volcanoes: those forces which the human mind cannot even distantly make an approximate calculation of will be harnessed and brought to the turbines of huge power plants and will produce, without any expense beyond ordinary maintenance, billions of kilowatthours at the service of our industry."

Alas, with how many illusions are the pathways of human progress paved! The "tremendous forces that feed the volcanoes" are quite far from being "harnessed" and placed at the service of our country's industrial development: indeed, frequent excesses without any advance warning, more undisciplined than ever, are permitted, and the "billions of kilowatthours" promised by the 1951 article in DOMENICA DEL CORRIERE quoted above have, to be sure, been consumed by industry, but only at the cost of equivalent thousands of tons of very expensive oil, paid for with good money and imported one year after the other.

And besides that, the SIFE, that cure-all company which was supposed to take care of all our troubles, was officially put into liquidation on 2 April 1957, after a short and obscure life and with no tears shed.

The facile enthusiasms of the 1950's are finished, unfortunately: now energy, and so much of it, serves for surviving, for heating houses and lighting lamps when the sun goes down. And we are beginning again, with far more modesty and so many fewer illusions, to examine the possibilities of using the geothermal sources to get heat out of them directly, or electricity indirectly, and while paying careful attention to the balances of costs and benefits and trying to foresee and avoid any possible injury to the environment.

Let us talk about this with Claudio Sommaruga, geologist, assistant to the general manager of AGIP for different energy resources, and one of the officials of the Methanopolis project, the first Italian pilot project in remote heating, which will involve offices and residential quarters owned by the SNAM [National Gas Pipeline Company] at San Donato Milanese.

Remote Heating Being Tested

First of all, it is advisable to make it clear what the new element is in this project and what its importance as a prototype consists in.

In Italy, there are already other plants that use heat from underground to heat residential spaces: 120 hotels in Abano Terme and 350,000 m^3 of Larderello office space have for some time been heated by, respectively, thermal waters and and the leftovers from the steam issuing from fumaroles. These, however, are special applications, done for the purpose of getting everything possible out of a resource extracted for primary uses of another kind.

In other words, at Abano they found they had more hot water than needed for the curative thermal uses, and at Larderello they have extra steam, at too low a temperature to supply electricity but still sufficient for heating (an analogous use could be hypothesized in other traditional thermoelectric power plants too), while at San Donato, testing is being done to determine the feasibility of purposely extracting water at a relatively low temperature to use it, as a primary use, for heating offices and housing units. It is desired, that is, to determine whether even in a geologically cold area such as the Po plain, it is possible to repeat an experiment which in Paris--where, however, the thermal conditions underground are better--already makes it possible to heat 20,000 housing units, while for another 35,000, the lines are being installed or feasibility studies are in progress.

"If the San Donato experiment proves suitable," says Sommaruga, "we will be able to start thinking about heating a vast area of the zone south of Milan with this system."

And here is the point: what is meant by "suitable?" What, in other words, are the technical and economic variables that make it possible to judge the validity of the experiment and the possibility of repeating it on a vast scale?

Geothermal Power Installed in the World, in Gross Megawatts,
according to the ENEL Forecasts

Countries	January 1980		Countries	January 1980	1985
Italy	450.60	550.00	Chile	--	20.00
France	0.20	0.20	New Zealand	202.00	302.00
Greece	--	3.50	Japan	76.00	330.00
Turkey	0.50	2.50	Taiwan	--	10.00
Iceland	62.50	62.50	People's Rep. of China	3.00	3.00
United States	665.50	1,969.50	Philippines	110.00	550.00
Mexico	180.00	400.00	Indonesia	0.25	30.00
El Salvador	60.00	95.00	USSR	5.75	5.75
Nicaragua	--	35.00	TOTALS	1,916.30	4,373.55
Guadeloupe	--	4.60			

Let us look at the technical aspect of the problem first of all, on the basis of Sommaruga's replies and publications by him and by his colleagues in AGIP and the SNAM.

That Methane Was Not Wanted

The first indispensable element is knowledge of the geological structure of the area involved: on this level, there is no doubt that the technicians of the ENI [National Hydrocarbons Agency] and its various associated companies have acquired broad and deep knowledge in recent years. The wearisome and, unfortunately, disappointing search for oil that has driven them to drill test holes all over the north and south of Italy has served the purpose, if none other, of collecting precise data not on oil, which was not there, but on everything that was there in abundance.

All this is basic knowledge that makes it possible to start out without being completely blind--even if, once a hole is drilled, no one can say with absolute precision whether what comes out is exactly what was expected. Just as at San Donato: it was expected to find a certain flow of water at 65° at a depth of about 2,000 m, and instead it was necessary to go to almost 2,500 m to find water at about 80°, and with a flow of 50-55 m^3 per hour--half of what was predicted. So far, not bad: the smaller flow is in a way compensated for by the higher temperature of the fluid.

But the real surprise--an unpleasant one, at least for now--was something different: up with the water comes, from the bowels of the earth, a considerable quantity of methane--a certainly nobler and energy-valuable product than hot water, but one which on this occasion is a great bother. In fact, evolving like a gas from the water in which it is dissolved under particular pressure and temperature conditions, it causes in the pumps the phenomenon of cavitation, which is well-known to the hydraulic engineers and which ruins the pumps irremediably.

Possible Use of Geothermal Fluids and Minimum Temperatures Required

(C°)

180 - Evaporation of highly concentrated solutions
Refrigeration by absorption of ammonia
Maceration of paper pulp

170 - Dessication of diatomites

160 - Dessication of fish pulp and wood pulp

150 - Alumina (Bayer process)

140 - Drying of high-yield agricultural products
Food-canning

130 - Evaporation in sugar-refining
Extraction of salts

120 - Soft water for distillation - Multiple-effect evaporation and concentration of saline solutions

110 - Drying and hardening of cement blocks

100 - Dessication of organic materials, seaweed, herbs, plants, etc
Washing and drying of wool

90 - Drying of fish - intense thawing

60 - Heating of housing units and greenhouses

60 - Heating of stables - Greenhouses with combined heating of space and ground

40 - Mushroom-growing - thermal cures

40 - Heating of the soil

30 - Swimming pools, biodegradation, fermentation
Thawing

25 - Fish-farming and cultivation of proteinaceous seaweed

"But there is a remedy for everything," Dr Sommaruga also says; "the right pumps just have to be found, and we are looking for them, with good prospects--we have made inquiries of manufacturers of special mining pumps who might have what we need; and then the problem of the methane will be turned around into a positive direction. In fact, when we have succeeded in separating it without damage to the pumps, it will even be possible to use it in the installation, with considerable economic benefits."

Geothermalelectric Power Plants in Italy

POWER PLANTS	Generator sets	Power per set	Total (kW)
Larderello 2	4	14,500	
	1	11,000	69,000
Larderello 3	3	26,000	
	1	24,000	
	2	9,000	120,000
Gabbro	1	15,000	15,000
Castelnuovo V.C.	1	26,000	
	2	11,000	
	1	2,000	50,000
Serrazzano	1	15,000	
	2	12,500	
	2	3,500	47,000*
Lago	1	14,500	
	1	12,500	
	1	6,500	33,500
Monterotondo M.mo	1	12,500	12,500
Sasso Pisano 2	1	12,500	
	1	3,200	15,700
Condensate plants (8)	27	--	362,700
Travale - Radicondoli	1	3,000	
	1	15,000	18,000
Sasso Pisano 1	2	3,500	3,500*
Molinetto	1	3,500	3,500
Lagoni Rossi 1	1	3,500	3,500
Lagoni Rossi 2	1	3,000	3,000
Valionsordo	1	900	900
Bagnore 1 (Monte Amiata	1	3,500	3,500
Bagnore 2 (Monte Amiata)	1	3,500	3,500
Piancastagnaio (Monte Amiata)	1	15,000	15,000
Back-pressure plants	11	--	57,900
Totals (17)	38		420,600*

4 Billion May Not Be Enough

Meanwhile, while the appropriate pumps are awaited, the experiment is marking time. Therefore, economic evaluation of the project as a whole--an indispensable element for deciding whether or not to repeat it in other areas --also still has many blanks in it, presently occupied--if one wants to have all the totals for the debit and credit columns--by estimates that could be modified by reality.

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*As published.

In any case, let us look at these columns, separating the costs from the benefits, as we should.

The complete plant will be composed of two wells; the first has already been drilled and has given the results stated. If all goes well, a second well will be drilled, which will be a short distance away from the first on the surface, but will move away, going into the earth on a diagonal.

Its function will be to reinject the water at the end of the cycle. This operation is indispensable for a number of reasons: to resupply the underground water-bearing stratum, making the energy source almost renewable; to avoid subsidence, the well-known geological phenomenon of slow sinking of the earth's crust that could be encouraged by extraction of the water; and for ecological and environmental reasons, inasmuch as the water extracted is highly saline and therefore cannot be put into open-surface watercourses.

The saline hot water that comes out of the well will be pumped to a heat exchanger, through which it will furnish heat to a soft-water secondary circuit and thence will be reinjected into the second well; according to the model worked out by the technicians, it is estimated that the supply water taken out of the stratum will not drop more than 1° C in about 50 years.

The complex of buildings to be heated, as planned by the project, will comprise a total volume of nearly 500,000 m^3, equal to about 2,500 standard housing units of 200 m^3 each.

At this point, it would seem that the elements for economic calculation are all at hand: on the one hand, the cost of the installation, wells, pumps for extraction and reinjection, piping; and on the other hand, the fuel savings, which are easy to calculate in view of the fact that the buildings to be heated already exist and it is known perfectly well how much is spent today. But in reality, matters are not so simple. The installation of a heat pum--that is, an intermediate heater running on gas-oil or methane and making it possible to maintain the fluid from the exchanger at an acceptable temperature, even at a certain distance from it--has to be provided; and it also has to be kept in mind that the geothermal heat can only furnish the so-called base energy, while the peak energy will in any case have to be ensured by a traditional heating system.

At any rate, the bottom-line estimate is to achieve savings of 1,500 tons-equivalent of gas-oil per year. But even this datum is not easy to compare with the plant-cost datum: indeed, while it is estimated that the plant will cost a total of about 4 billion, it is not known how much gas-oil will cost in the coming years, nor for how long the recently discovered geothermal energy source will be available.

As one sees, calculations that are far from simple and are subject to continual variations are involved. One thing is certain, though: the cost of the project is high, and keeps on rising.

This is a factor that the technicians of AGIP and the SNAM do not conceal: Engineer Bonfiglioli of the SNAM cited it at a recent conference in Piacenza. At the present cost of gas-oil, the energy savings should repay the investment in 20 years, which is a very long time and during which the plant could require modification or prove outmoded in some way.

But this, it is said, is a risk that should be run, both because the plant is an experimental one and its cost should therefore be considered by the standard of any investment in research, and because remote heating could spread into far vaster areas, without undoubted reductions in the general plant costs.

Finally, because this is not a matter of a simple alternative among technical projects of different costs, from among which we must choose the most advantageous one, but because, on the one hand, we have an energy source that is difficult to manage, more expensive than anticipated, but certainly available, and free of charge once it is harnessed, while on the other hand is the dramatic certainty of the imminent exhaustion of oil reserves.

Projects such as the San Donato one must necessarily, then, be moved forward--at least in order to determine how much we can count on possibilities so far discussed only theoretically or at random, so that we can then learn, if such be the case, that they are not practicable and that it is necessary to face up conscientiously to the challenge of saving and of the search for still other new energy sources.

11267
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COMBUSTION EXPERIMENTS TO BE RUN

Milan L'UNITA in Italian 19 May 80 p 6

[Article by Valerio Pelini: "A Considerable Source From Solid Wastes--Quite a Lot of Energy Not To Be Thrown Onto the Garbage Heap--The Experiment About To Be Carried Out in Tuscany--A Power Plant Will Burn Lignite and Garbage Together"]

[Text] Fourteen Million tons of solid wastes per year. If the Italians were to put all their garbage together, it would make an enormous, immense mountain--a mountain of waste paper, rags, plastic and other rubbish. The problem of getting rid of this big trash-heap has tormented scientists, administrators, ecologists for decades: today, more than 80 percent is put in dumps; 10 or 12 percent ends up in incinerators; and only the remaining 7 or 8 percent is subjected to recycling or composting.

However it is treated, refuse has until a few years ago created mainly a problem: pollution. There are few controlled dumps, and incinerators unleash endless disputes. But since a short time ago, thought has been given to recovery of garbage from the energy point of view also. In Italy, the first to look at waste as a possible fuel were the technicians of the National Research Center, who, within the framework of the "purpose-directed energy project," have devoted studies and research to plain old urban solid waste. From among the various plans conceived, one will be implemented in Tuscany, in the thermoelectric power plant of Santa Barbara, a segment of the commune of Cavriglia.

What is involved in practice is mixing and burning in the power plant's combustion chamber a mixture composed of lignite (which is the power plants' traditional fuel) and suitably pretreated garbage.--that is, with the iron, glass and other inert materials removed. The experiment--proposed by ENEL [National Electric Power Agency] more than a year ago, and preceded by three encouraging tests--really seems to be at the point of starting up. The draft of an agreement to be established among ENEL, the associations of the zone's communes, the commune of Cavriglia, the Tuscany Region, the provincial administration of Arezzo, and the National Research Council (CNR) has already been prepared.

When all the signatures are affixed at the end of the long document, the experiment will get under way, and the power plant's conveyor belts will gradually start dumping into the combustion chamber a mixture in which the proportion of garbage will rise from a minimum of 2 or 3 percent to a maximum of 10-12 percent. The dozens of tons of garbage needed will be pretreated a special plant developed by the technicians of ENEL's Pisa research center. The experiment should last about a year. If all goes well, the CNR plans to experiment further with a coal-fired power plant.

Lignite is being used to start with today because there seems to be a considerable affinity between the energy characteristics of this ancient fuel and those of the pretreated refuse. The Santa Barbara power plant has been chosen because it is one of the two lignite-fired power plants still functioning in Italy. The technicians of the National Research Center have christened this experiment "cocombustion," and it seems to be the first attempt of its kind in the world.

There are similar but not identical things abroad. In Monaco, for example, there is a power plant in which a boiler burns coal and fuel oil, an incinerator burns waste, and only the fumes are then conveyed through a single stack.

In Tuscany also, in Cavriglia and in the bordering communes, the administrators, the political forces and the trade unions are asking for specific guarantees against the poisonous fumes. The draft agreement prescribes rigorous controls during and after the combustion tests, which may then resume only after all the analyses prove reassuring. But the best guarantee seems to lie in the temperature of the power plant's combustion chamber, which is higher than 1,000° and eliminates every microorganism. The tests will be gradual (that is, the proportion of garbage will be increased very slowly) and limited in time, with a maximum of 15 or 20 days. The experiment therefore seems realizable from all points of view.

Solid waste is a subject that has interested the Region for some time. Indeed, several of the most interesting experiments in the field of garbage recovery have been attempted in Tuscany--in Pistoia, for example, where there is a composting plant that transforms trash into an excellent fertilizer. In the territorial development department, they are convinced that in order to solve the "waste problem" it is necessary to work on many levels, from dumping to incineration to recycling to other systems, such as that proposed by the National Research Center for Santa Barbara. Cocombustion could become an important element in the Tuscany Region's package of initiatives. It could become an interesting theme on the national scale also: one kilogram of garbage has a heating power of between 1,400 and 1,800 kilocalories. A little arithmetic shows that even if only half of the 14 million tons of waste is recovered, a source equal to 1 or 1.5 percent of national energy needs is available--a source that is renewed every day.

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WORLD'S LARGEST WIND POWER PLANTS REVIEWED

Stockholm NY TEKNIK in Swedish 10 Apr 80 p 34

[Text] NY TEKNIK has reviewed the largest wind power plants in the world.

The table below shows the power plants in operation or under construction today.

With regard to large power plants of this type the world leaders in the field are the United States, Sweden and Denmark.

West Germany has long planned an enormous power plant with a 100-meter turbine diameter. To date no delivery contract has been signed. Many observers in other countries doubt that it would pay to carry out the German project.

Except for the power plant in Tvind all the plants were paid for out of state research funds.

They also have in common the fact that all are prototypes for testing technology and gaining operating experience prior to mass production of wind power plants.

All the countries are conducting wind measurements and studies of power systems in parallel with the trial operations.

The United States is now the furthest advanced internationally since 800 MW of wind power will be installed by 1988. Of these 700 MW will be in large plants with over 100 kW effectiveness. The Swedish Karlskronavarvet has just become a subcontractor via Hamilton Standard for the latest power plant ordered, WTS 4. This is almost identical to the one ordered from the shipyard by the Swedish Board for Energy Production Research in the fall of 1979.

In Sweden a decision could be made on a large wind power program by 1985 though before then industry will build a large demonstration plant (see also NY TEKNIK No 2, 1980, "Energy Alternatives").

	Kalkugnen Sverige(1)	Mod 1 USA	Tvind(2) Danmark	Nibe Danmark	Mod 2 USA	Maglarp Sverige	Näsudden Sverige	WTS 4 USA
Year ready:	1977	1979	1979	1980	1980 -	1981-82	1982	1982
Turbine diameter:	18 - 25 m	60 m	54 m	40 m	91 m	78 m	75 m	78 m
Hub height:	25 m	40 m	53 m	45 m	61 m	80 m	80 m	80 m
Wind strength at full efficiency:	10 m/s	11 m/s	14 m/s	13 m/s	12 m/s	14 m/s	13 m/s	16 m/s
Generator efficiency:	60 kW	2 MW	2 MW	630 kW	2,5 MW	3 MW	2 MW	4 MW
Annual production:	?	6 GWh	6 GWh	1,5 GWh	10 GWh	9 GWh	7 GWh	16 GWh
Manufacturer:	Saab-Scania	General Electric	Tvind-skolen (3)	Flere (4)	Boeing	Karlskrona-varvet	Karlstads Mekaniska Werkstad	Hamilton-Standard Karlskrona-varvet

Key:
1. Sweden
2. Denmark
3. Tvind school
4. Several manufacturers

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INDUSTRIAL TECHNOLOGY

FRANCO-GERMAN TELEVISION SATELLITE VENTURE

Competition for Markets

Paris AFP SCIENCES in French 24 Apr 80 pp 10-11

[Text] One of the principal objectives of the promoters of the Franco-German system of direct television by satellite is to reach the enormous potential export market that could open up to them. So said, in substance, on 21 April, Mr Pierre Usunier, one of the directors of the Aerospatiale Company, on the occasion of the 16th international market of television programs (MO-TV) which is currently being held in Cannes.

The Aerospatiale company and its partner, Thomson-CSF (France) have undertaken to build, with their German partners MBB and AEG-Telefunken, three direct television satellites, one for each country, plus a spare one. The French model is supposed to be launched by the missile, Ariane, at the end of the year 1983 or the beginning of 1984.

An intergovernmental agreement, regulating the technical, commercial and financial points of the cooperation program should be signed between now and the end of the month by France and the FRG, it is indicated from a reliable source.

But the French leaders are above all bent on a great bet. Besides national coverage of the country by direct television, they wish to convince foreign partners of the viability of the Franco-German system in face of the threatening competition of projects currently developed by Japan and the United States.

In 20 years this potential market could, whenever the customers might so decide, amount to 10 direct television systems, including 30 satellites launched by 30 missiles, Mr Usunier indicated.

If you figure on more than 700 million francs per system (8n constant francs), the value of this market would represent from seven to eight billion francs. And certain countries have already expressed an interest, he explained.

China cannot reasonably get along without direct television, according to the French leaders. The installation of classical ground networks all over such a vast and heavily populated territory is indeed for this country so costly as to be totally prohibitive.

Contacts have been made between the Chinese government and the German MBB company.

A group including five Nordic countries and Iceland might likewise be tempted by one or more direct television satellites of the same type as these developed by France and the FRG. Finally Luxemburg, which has five channels at its disposal for a very broad coverage, might also turn to the Franco-German consortium, Mr Usunier explained.

But in the long term less advanced countries (Argentina, Brazil or countries of the Middle East) which wish to develop ambitious educational programs likewise represent a very important potential market.

On the national level, the industrial bet which should enable the Franco-German system to be a rival in face of Japanese competition, is to equip, within the next ten years, ten percent of the national television park with parabolic antennas and frequency converters (about 2,000 francs) making it possible to receive direct television.

This figure would represent nearly 100,000 units sold each year, explained Mr Christian Loeffler, one of the heads of the Thomson-CSF company.

But to achieve these objectives an additional service must be offered to the French television audience. And nobody during the meeting was able to indicate what the program broadcast by the third channel of the direct television satellite would be, the first two being occupied by TF1 and Antenna-2.

Better coverage by the satellite of the "shadow zones," i.e. one percent of the national territory, not being from a reliable source, an argument capable within itself of inciting millions of television watchers to spend 2,000 francs for the simple pleasure of receiving direct television. [Sentence as published.]

Provisions of Agreement

Paris AFP SCIENCES in French 30 Apr pp 3-4

[Text] Paris--Signing of the Franco-German agreement on satellites for direct broadcasting. The Franco-German agreement on technical and industrial cooperation in the matter of satellites for radio broadcasting was signed in Paris 29 April by Mr Volker Hauff, minister of research and technology of the FRG, and Mr Andre Giraud, French minister of industry, in the presence of Mr Jean-Philippe Lecat, minister of culture and communication.

This agreement follows up on decisions which had been made at the time of the Franco-German summit meetings of October 1979 and February 1980. It provides that the program will include the perfecting, the realization, the launching and the placing in orbit of two preoperational satellites (with a spare satellite on the ground in addition) which will call for joint technical solutions and will be identical, except for the specific equipment involved due to differences in the missions required by the end-use administrations in each country. One of the satellites will be used for German needs, the other for French needs in compliance with decisions reached at the world administrative conference on radio communications in 1977. Each one will comprise three television channels. Both will be launched by the Ariane missile in 1984, and will function in geostationary orbit at 19 degrees west.

Thus it is a matter of putting into place a preoperational system which will include on the French side a satellite in orbit and an earth station for sending from the ground sound signals and images to be broadcast. Its principal objective is to make it possible to acquire a full range of abilities for the materialization and utilization of satellites of this new type and to create thus technical and industrial conditions for their future manufacture and their sale on markets which will not fail to develop in different regions of the world.

Financing will be shared in two equal parts between France and the Federal Republic of Germany. A joint industrial organization destined to insure the combined management of the program will be set up under the control of official Franco-German decision-makers.

In mid-1980 francs the total cost of this program is estimated at 1,700 million francs including 1,200 for the satellites and 500 million francs for the two launchings (each launching will cost 200 million francs plus 40 million francs for insurance).

The first satellite launched will be German or French "according to which one will be ready first. The second will follow some months afterwards."

The two ministers, Mr Giraud and Mr Hauff, insisted, as did Mr Lecat, on the experimental character of these first two satellites for direct broadcasting. "They will be utilized only by France and Germany," they said. They likewise pointed out that "the export effort will be made on a common basis."

It is known that four companies, two German, MBB and AEG Telefunken for the FRG, SNIAS and Thomson-CSF for France, have constituted an industrial group for the manufacture and marketing of satellites for direct broadcasting.

Where the third channel on the French satellite is concerned, no decision has been reached yet, Mr Lecat indicated. The first two channels will serve for broadcasting, in duplication of the ground networks, the programs of the TF1 and A2 companies.

An earth station responsible for transmitting towards the satellite will be built, probably in the Yonne region not far from Auxerre.

At the end of the signing ceremony for the Franco-German agreement Mr Lecat took care to stress that direct broadcasting "was not going to take away any of the printed press's publicity income." "Pluralism will be maintained among the media; hence no publicity tapping in the printed press which could expose it to danger," the minister affirmed.

"In any event," Mr Lecat added, "the parliament will be brought in on decisions. We have time not to make any hasty decisions."

9498
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FRANCE, ROMANIA DEVELOP IN SITU COMBUSTION IN OIL FIELDS

Paris L'INDUSTRIE DU PETROLE GAZ-CHIMIE in French Mar 80 pp 84-86

[Article by Yves Naudin: "A Profitable Long-Term Technique."]

[Text] In situ combustion, which is used for heavy oils, should allow the rate of recovery to be brought to 45 percent for certain beds, from now to the end of the century. This process, which has not yet been greatly developed, and often at the laboratory stages, has been experimented on to a great degree with the Suplacu and Balaria beds in Romania. The IFP [French Petroleum Institute] which has been cooperating on these projects since 1969, has been carrying on in-depth tests in the lab. On the economic plane, in situ combustion requires large investments and the technical production cost varies between $5 and $15 per barrel.

The classical processes of petroleum recovery do not presently allow underground extraction of more than 30 percent of the amount of oil initially in place. Through the development of new processes of assisted recovery, this rate could reach 45 percent by the end of the century. Methods differ according to the characteristics of the bed and the quality of the oil. Thus, in the category of thermic processes, vapor injection and in situ combustion would be used. These techniques rest on the principle of introducing supplemental energy to the bed through heat, which would allow the reduction of the crude's viscosity. Thus, they are mainly applied to heavy crudes, and rate of recovery could reach 50 percent. In situ combustion has as its goal the production of heat within the reservoir. Combustion is brought about by leading air into the producing bed by a specific number of injection wells. A slow combustion front is thus developed, whose temperature is between 400 and 600 degrees centigrade, which is displaced toward the producing wells. This front pushes before itself a complex mixture of combustion gas, water vapor, and hydrocarbons which are vaporized and then condensed, and finally the virgin oil of the bed, which is reheated.

The fundamental element of this concurrent combustion is "coke," a heavy deposit formed in front of the combustion front by cracking and pyrolysis, and which is in fact the combustible that burns. The oil produced is thus partly lightened and relieved of its heavy and least profitable parts.

A variation on this process consists of injecting air and water at the same time. This would be humid combustion. Part of the water is vaporized, assuring a more efficient deplacement of the hot zone. These techniques, which pertain exclusively to heavy and viscous oils, cannot, however, be applied at depths which are greater than 1500 m, due to constraints caused by the injection of pressurized air into the bed.

A Franco-Romanian Feat

This process, which still has not been greatly developed, is in the trial stages on pilot beds in the United States, Canada and Venezuela. But the most important project is the Suplacu in Romania, which is allowing the recovery of 40 to 45 percent of viscous crude instead of 9 percent (primary recovery).

Unique in the world, that experiment is the result of cooperation dating back to 1969 between the French Petroleum Institute and the Ministry of Mines, Petroleum and Geology of Romania (MMPG). The accord signed at that time provided for the common sharing in the experiments carried on by the two partners since 1964: laboratory work in France and pilot experiments of in situ combustion in Romania.

For the first time, MMPG has provided the materials necessary for the development of in situ combustion, on pilot, and then industrial, levels: equipment, both on the surface and in the ground, for the separation of the fluid produced and for the refining and rejection of burned gases.

The Suplacu bed lent itself especially well to the application of concurrent combustion: a reservoir which was not too deep, 50 to 150 m; 10 m thick; and with an oil viscosity of 16 degrees API [American Petroleum Institute]. Combustion was first tested on pilot panels, and then expanded to a wide zone located at the reservoir's highest point, and finally applied at the industrial level.

The nominal capacity for air injection is now 2100 Nm^3 and the process makes use of 32 injection wells and 205 production wells.

Likewise, thanks to the IFP's laboratory work, humid combustion was tested and then applied industrially. Performance was able to be improved, and that type of combustion could be applied when dry combustion requires too high an air flow. Finally, water injection into a formation, after sweeping by dry combustion, was likewise applied on certain fields.

The discovery in 1960 of the Balaria reservoir permitted experiments with in situ combustion at greater depths. The bed, 800 m deep with a total thickness of between 3 and 15 m, contains oil at 19 degrees API. It was first the subject of pilot tests before being experimented on at the industrial stage.

In cooperation with the IFP, the Romanians started the work in 1975. After the tests proved satisfactory, they decided to use the bed for industry.

The project will be set up in stages, with the total number of wells needed by Balaria exceeding 1000. Each stage will involve 100 wells for 3 to 4 years. The compression station will be 14,000 horsepower and will be able to compress 1.5 million Nm^3/j at 60 bars ["atmospheres"]. The amount of supplemental oil capable of being immediately produced is estimated at 20 percent of the oil in place.

The IFP's Efforts

Improvement of in situ combustion techniques requires laboratory experiments. In France, the IFP has means for appropriate study which allows for the analysis of different parameters influencing the setting up of in situ combustion. Thus, tests for oxidation of an oil in a porous environment permit the oil's oxidation at low temperatures to be measured, as well as its ability to form the "coke" deposit used for combustion.

Similarly, the IFP plans to study the propagation of the combustion front which will allow them to obtain:

-front speeds, and the amount of necessary air per unit volume of porous mass;

-effectiveness of combustion

-the maximum temperature reached

-rate of recovery and characteristics of the effluents

-amount of oil burned per unit volume of porous mass.

Finally, before application in the field, a preliminary project is set up based on the laboratory testing. On an economic level, in situ combustion requires large investments, because of the installation of air compressors and the cost of drilling. The technical cost of production varies, according to the difficulties encountered, from between $5 and $15 per barrel, while investments are between $5,000 and $10,000 per barrel per "J" [expansion unknown]. The essential parameter determining economics is the relationship of the amount of air injected to the amount of oil produced. This relationship varies from between 500 and 3,000 in the useful cases, and the low values are obtained by injecting water in combination with air.

This technique is, however, still a delicate one to implement and is being developed slowly. Besides the Romanian experiments, 25 projects exist in the world today, representing some million tons per year.

However, the drying up of light petroleum beds should cause an accelerated use of viscous oils and in situ combustion. This process should, moreover, be able to include crudes with densities greater than 0.98 (13 degrees API), vast reserves of which are found in Venezuela and Canada.

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INDUSTRIAL TECHNOLOGY

PLANNED USE OF JAPANESE STEEL TECHNOLOGY DISCUSSED

Stockholm NY TEKNIK in Swedish 17 Apr 80 pp 26-27

[Article by S-O Carlsson and Miki Agerberg]

[Text] Domnarvet's strip and thin sheet metal division is in the midst of a large investment program: with investments of 1.5 billion kronor, the company hopes to more than double its share of the market in Sweden, Norway, and Denmark during the eighties.

Technically, the most interesting part is a new production line from Japan. It will shorten the time for the final steps at the cold rolling mill from 10 days to 10 minutes and, among other things, produce new types of highly durable steel, one of which Domnarvet will be the only company in Europe to produce.

Domnarvet is counting on finding a large market in the Swedish auto industry, among other places, which currently purchases its sheet metal from abroad.

A total of 1,541 million kronor is now being invested in Domnarvet's rolling mill in a project going under the collective name Band 82. Part of this sum is being granted as a state subsidy to mitigate the effects of structural changes within Svenskt Stal AB, SSAB, which includes Domnarvet.

Continuous Process

Around half the invested money is going to the cold rolling mill. One of the heaviest items there is the new production line for continuous annealing, bought under license from the Japanese company Nippon Kokan.

It involves the three final steps in cold rolling--annealing, trim rolling, and shearing into rolls--which will now be joined into one continuous process.

A large part of the sheet metal is heat treated after cold rolling so it can be pressed. It is this that is called annealing. This presently takes place at Domnarvet in the following manner:

The rolls of cold rolled sheet metal are placed on end in so-called bell furnaces. Several rolls can be stacked on top of one another. The bell furnace consists of an inner bell filled with a protective gas and an outer one that does the heating.

The sheet metal rolls are heated to 700-800 degrees Celsius and then allowed to cool. This process takes around 3 days. Then the rolls are lifted out and allowed to cool further to room temperature before it is time for the final rolling--trim rolling.

Here there is another break in the process and more lifting before shearing and the other elements of finishing can take place and the sheet metal is ready for delivery to the customer.

This entire process, from the time annealing begins until the sheet metal is ready, normally takes around 10 days. It is divided into three stages with lifting and storage between each stage.

Improved Quality

In the new Japanese production line, all the elements are joined into one continuous process that takes around 10 minutes. An additional step is also added before annealing: electrolytic cleaning. This is a measure that improves the quality. Today it is used at Japanese steel mills but will be new to Europe.

After cleaning, the sheet metal passes through an annealing zone where it is heated for several minutes at 700-800 degrees Celsius. It is then cooled in seconds in water.

A light pickling bath removes an oxide layer formed during water cooling and the sheet metal is next heated for several minutes in an aging furnace to 200-300 degrees Celsius to increase its hardness.

After again cooling, the sheet metal goes directly to trim rolling and completion.

The new fast annealing line will have a capacity of 465 thousand tons per year compared to the 175 thousand ton per year capacity today. But it will also produce more even quality and the possibility of making new types of highly durable steel that cannot be made today.

"An open steel surface is annealed instead of heating entire rolls," civil engineer Karl-Erik Moren of Domnarvet says. In this way, more even properties are produced in the sheet metal. This, together with the electrolytic cleaning, makes the surface very clean. Problems with graphite and dirt are avoided which, among other things, allows the paint to adhere better.

Steel For the Auto Industry

It will be possible to make two types of highly durable steel that cannot be made in bell furnaces. They go by the common name of dual phase steel. One of these types of steel can also be manufactured at a rolling mill in Belgium, while Domnarvet will be the only company in Europe producing the other.

The latter type, called "Dual phase bake hardening," possesses properties that make it interesting for the auto industry, among others. It can be shaped and easily pressed into various auto parts. When it is later heated for the paint to dry, it hardens further and becomes highly durable.

Its durability means that thinner sheets can be used in automobiles. For example, in the front fenders it will be possible to go from 0.8 mm thickness down to 0.7 mm. Because of the reduction in weight, gasoline consumption can be decreased.

"At present, we do not deliver much sheet metal to Swedish auto plants," says Lars Granse, who is in charge of cold rolling at Domnarvet. "It is a matter of a small portion, going mostly for truck production."

"Sweden's auto industry buys its sheet metal from other countries in Western Europe. Now we hope to take over 25 to 30 percent of the Swedish auto industry's needs."

The new continuous annealing process produces sheet metal that is 0.5-1.6 mm thick in widths between 600 and 1,550 mm. The process involves the use of very little alloy metal which, among other things, provides good welding properties.

The cold rolling mill is also investing in a new pickling section and a fifth pair of tandem mills. In 1982, when the first stage of investments in the cold rolled sheet metal will have increased from the present level of 400 thousand tons per year to over 700 thousand tons per year. It is estimated that by 1987, after minor additions, it will have a capacity of around 1 million tons per year.

Doubled Share of Market

The capacity of annealed sheet metal will be around 540 thousand tons per year. In addition to the new continuous line, some of the bell furnaces will be retained to handle sheet metal thicker than 1.6 mm.

"One reason for the investments is to remove bottlenecks," Lars Granse says. At present, we cannot make use of the full capacity at the tandem mill we invested in previously."

"We will also produce higher quality sheet metal and greater productivity per employee."

"Today, we are technically capable of producing around half the cold rolled sheet metal needed in our home market, i.e. Sweden, Norway, and Denmark. With the new investments, we will be technically able to produce around 95 percent of the demand."

"This means we hope to increase our share of this market from the current level of 20 percent to nearly 50 percent."

The products range from conventional cold rolled sheet metal to highly durable, pressable sheet metal. They will be used, among other things, in industrial engineering, appliances (for example, in refrigerators), and the automobile industry.

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SCIENCE POLICY

ORGANIZATION, OPERATION OF RESEARCH CRITICALLY ASSESSED

Frankfurt/Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 12 May 80 p 5

[Article by tn: "Only Four Projects for Each Research Administrator"]

[Text] Frankfurt, 11 May--In 1980, the FRG Ministry for Research and Technology will have an estimated budget of DM 6 billion for the promotion of research. In recent weeks, criticism of the Research Administration has been voiced, above all, by industry. Therefore, the table on the following page presents a few facts about the Research Administration provided by the Ministry for Research, to enable unbiased observers to form their own opinions about the Research Administration.

A look at the expenditures of the Ministry for Research reveals that they are appropriated in the following manner, by percentage: Support of 36 different scientific institutions, 37.8 percent; government subsidies in varying amounts to support research projects in industry, research institutes and others, 46.4 percent; contributions to international organizations, 12.6 percent; 3.3 percent of the expenditures for miscellaneous items (education, administration).

For 1978, comprehensive figures are available in various publications. They will therefore be used in the table as a basis for the presentation of the Research Administration.

In 1980, the ministry has approximately 730 employees, 640 of them are classified as permanent employees and 90 as temporary help in various capacities. In 1978, the number of employees was 687. In addition, however--and since the beginning of the 1970's it has been realized even more--there are employees who work with so-called "project contractors." They work at various institutions, for instance, research centers that are under the jurisdiction of the Ministry for Research, and they are assigned by the Ministry for Research to supervise research projects. For 1978, the total number of these employees was 553 at a cost of approximately DM 44 million. Also, there are about 125 employees involved in the so-called follow-up work of projects. They are workers involved in overseeing the continuation of projects that have been concluded. Thus, in 1978 the total number of research administrators came to 1,388. The figures for the research bureaucracy were systematically tabulated for 1978 and are presented in the table. It is significant that each research administrator is only responsible for four research projects. Normally, in the area of research administration, at least in industry, but also according to the report put together by the ministry itself, the average number of research and promoted projects that can be administered by one person per year is estimated at 20 projects.

Indices for the Promotion of Research
in Industry Supported by the Ministry for Research
(Example 1978) Outlays in DM million

Purpose	Number of projects	Amount of grant	Percentage
Total grants to industry	2,692	1,595	100
among them			
1.1 small and medium-size enterprises	562	119	7.4
1.2 research groups	156	46	2.9
1.3 organizations and other research establishments in industry	112	49	3.0

Source: BMFT 1978 Promotional Catalog and Bundestag Publication 8/3170

It must certainly be taken into consideration that in addition to promoting actual projects that are primarily--at least in some areas--conducted by project contractors, the Ministry of Research must also engage in political research activities. This has a bearing on the relatively low figure and number of projects per research administrator.

The Ministry for Research has acquired an advisory system with a specific advisory structure and its own advisory reports. The actual meaning and purpose of this is to provide research administrators in the Research Ministry with expertise provided by outside experts, to bring about better decisions in research policies. Practice has shown, however, that this is not the case. At the present time, there are more than 1,200 advisors, and new advisory departments are created continuously. And recently a new trend has emerged, according to which all "social groups" are to be considered when filling various advisory departments. Naturally, this leads to inflated circles of experts.

A special chapter is the awarding of reports and studies. According to the figures contained in the promotional catalog issued by the Ministry for Research, in 1978 DM 57 million were allocated for reports and studies. It was after the record year of 1976, when as many as 436 reports and studies were authorized at a cost of DM 65 million. On the basis of a number of protests by the Bundestag, after 1976 the statistics were streamlined. In spite of this streamlining, there is still a multitude of reports. Most of the so-called reports and studies by the Ministry for Research are not available to the public. Some of them are not even available in the ministry. In 1978, there were 61 reports at a cost of DM 23.9 million in the area of energy research alone. Since only 70 officials and staff members are working in the area of energy research administration of the Ministry for Research and only 30 of these people have the necessary knowledge to read these studies and reports, one can imagine the flood of reading material that has to be read by these officials before they can make the assessments necessary for completing the requested reports. The assumption is that for all practical purposes these reports and studies are essentially only intended to justify preconceived decisions in research policies after the fact.

In contrast to the United States, where all reports from the private sector are published, this is not the case in the FRG. Neither does the Ministry for Research have the intention of making available all reports and studies for criticism from the public. Even delegates are having difficulties in getting certain reports from the Ministry for Research.

Figures on Research Bureaucracy
of the Ministry for Research (Example 1978)

1.	Full-time employees and temporary help in the BMFT	710
2.	Workers for project contractors	553
3.	Workers for continuing projects	125
3.1	Total number of research administrators	1,388
4.	Advisors in BMFT departments	1,200
5.	Studies and reports at DM 5 million	317
6.	Number of funded projects at DM 2.195 billion	5,081
7.	Funding for projects in industry at DM 1.6 billion	2,692
8.	Number of projects per research administrator for the BMFT (6. divided by 3.1)	4

In addition to the advisory and reporting system within the Ministry for Research itself, individual project managers have added their own assessors, as have the research centers under the jurisdiction of the Ministry for Research. Even well-seasoned employees in the Research Ministry can no longer oversee the flood of experts in all these institutions.

In 1978, the base year under consideration, a total of DM 2.195 billion was spent on the promotion of targeted research projects, in other words, the so-called "project promotion." DM 1.594 billion of this amount or 72.6 percent of the Research Ministry's project promotion funds went to industry. The promotion of research in industry is illustrated in the table, with 1978 as the sample year.

Only a Small Percentage for Medium-Size Enterprises

Only 7.4 percent Research Ministry funds allocated to industry goes to small and medium-size enterprises. As a rule, the Ministry for Research publicly states that the figure for 1978 is 13.4 percent. But subsidies to research groups and organizations as well as other research establishments in industry are included in the category of small and medium-size enterprises. This is done although there is no doubt about the fact that many large enterprises are involved in these research groups and organizations.

When picking up the 1978 promotional catalog to investigate in detail the structure and the firms involved in receiving funds from the BMFT [Federal Ministry for Research and Technology], it becomes apparent that as much as DM 677.7 million is allocated to 26 large firms and involves 47 projects. The remaining DM 916.9 million of the promotional monies and 2,645 projects are distributed over 763 recipients in industry. Therefore the following conclusions may be made:

1. A few large enterprises, except in the area of chemistry, are receiving the largest share of the Research Ministry's promotional funds which are available to industry.

2. There is no evidence that the German industry in its entirety is becoming dependent on the government, since only 760 firms received public research monies from the Ministry for Research.

3. Small and medium-size enterprises are still playing only a subordinate part in spite of a certain rise in allocations that has occurred in recent years.

Whoever has the courage to enter the adventure of applying for research funds to the Ministry for Research should first look at the forms and be aware of the red tape that will follow before, perhaps, applying for a certain grant. As an illustration, there are a few figures: In 1975, the ministry introduced a certain application form suitable for EDP; in 1979 it was changed again. The fact that the Ministry for Research was able to reduce the new form to 6 pages instead of 9 of the DIN A 4 size, is seen as a big success by the ministry. It is almost impossible for a first-timer to fill out the forms of the Ministry for Research without the assistance of an experienced person or spending much money. In other words, the expenditures for the application and reporting system should be assessed in detail.

Within the framework of its audits, the Federal Accounting Office has also been investigating papers submitted to the Ministry for Research upon completion of projects containing statements about the use of funds. For years, the Research Ministry has argued in favor of direct research grants, because it would provide stricter control over expenditures since the ministry had available statements indicating the use of these funds. In comparison, this would not be the case if research grants were awarded indirectly through tax relief or subsidies. In reality, however, as described by the Federal Accounting Office (Bundesrat Publication 494/79), the control of statements on the use of funds is as follows: "At the end of September 1978, 2 months after the established deadline, the statements of use which had not been checked included 326 (30 percent) in the ministry and 840 (35 percent) among those involving project contractors. By the end of September 1978, the backlog (of statements of use) to be examined amounted to 1,822 projects."

According to Federal Accounting Office figures, the ministry expects that by 1982 the number of funded projects will rise from a present figure of 5,000 to 8,000. In addition to checking statements of use in the ministry itself, so-called "on-site audits" must be made of the use of funds by the recipient of the money. These audits, to which the enterprise has to subject itself, have been transferred to the price-control authorities of the Laender.

To date, the FRG Ministry for Research has not yet authorized a report accounting for the expenditures and benefits associated with the promotion of projects.

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NEW PROGRAM LOANS RESEARCHERS TO BUSINESSES

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[Article by Lasse Sandstrom]

[Text] Karl Johan Astrom, professor of control technology at Lund University, has been assisting Telsand Electronics, Inc., Arlov, in developing a control system for plastics production. His work forms part of a project, entitled "contact research."

"Contact research" is a program under which universities lend their researchers to industrial enterprises for purposes of developing new products. The prerequisite is that the enterprise (or government agency) has a "problem" which lends itself to scientific work.

Fosam (the Committee of Research Cooperation) has, so far, launched twelve projects. The projects cover a wide area, ranging from the development of clogs to the solution of municipal problems.

In addition to the University of Lund, technical universities and the University of Gothenburg participate in the work in Alvsborg county, the University of Uppsala works in Gavleborg county, and technical universities and the universities of Umea and Lulea work in the counties of Norrbotten and Vasterbotten.

The research activities are primiarily directed toward small and medium-sized enterprises--an upper limit has been fixed at 200 employees. The researchers are lent for a period ranging from 6 to 12 months. The government defrays the costs. Investments and other costs are paid by the enterprises concerned.

The twelve projects arranged by Fosam will cost Swedish taxpayers 1.3 million kroner. A total of 35 enterprises and government agencies have applied for assistance. It has thus not been possible to help everybody.

At the end of the period of the experiment, in 1981, the whole program will be evaluated.

"We shall, among other things, examine the cost distribution," says Kerry Persson, secretary of Fosam. "Whether the government will have to pay in the future, we do not know. It is hard to predict what the final solution will be."

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FIBER REINFORCEMENT OF CERAMICS STUDIED

Stockholm NY TEKNIK in Swidish 24 Apr 80 p 40

[Article by Erik Mellgren]

[Text] The fragile property of ceramics is its big drawback. But by reinforcing ceramics, by adding composites of fibers or particles to the ceramet, it is possible to circumvent this problem.

Our early ancestors among the Stone Age people had detected the fragile nature of ceramics. The enormous quantities of broken pieces of pottery, which are among the most common finds of archaeologists, bear witness to this. But in some areas solutions were found already during that time. Several finds have been made of earthernware, reinforced with asbestos or similar mineral fibers.

The effect of reinforcement is that the work required for cracks to grow increases. More work is needed to loosen fibers from the ceramet material or to separate them from it.

This also implies that a reinforcement of good quality must have a high tensile strength and must be able to withstand tensions, at the same time being strongly bound in the ceramet.

According to a report of the Swedish Institute of Silicate Research, it is possible to increase the breaking strength of a ceramet material by means of fiber reinforcement. An example of reinforcement experiments is reinforcing silicon nitride with fibers of silicon carbide.

Particle Composites

Particles, too, may be used for reinforcement. An example is aluminum oxide which may be reinforced by means of other oxides, primarily zirconium dioxide. The zirconium oxide changes its crystal structure by heating and this causes a number of small"microcracks" to form in the material.

Microcracks are capable of arresting the growth of big cracks. A crack which starts developing is deflected and continuously ramified by the microcracks. For this reason, more work is required in order for a crack to grow than in the case of pure ceramet.

According to the report of the Swedish Institute of Silicate Research, particle composites provide no dramatic improvements in the mechanical properties of ceramets. This then in contrast to fiber reinforcement.

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R&D IN LIGHTER-THAN-AIR CRAFT: WORLDWIDE SURVEY

Rome SCIENZA & VITA NUOVA in Italian May 80 pp 42-47

[Article by Marie-France Le Meignen: "They Consume Little, and the Oil Crisis Is Reviving Them--Dressed Up Like Flying Saucers, the Dirigibles Are Reappearing"]

> [Text] The new technologies make them more reliable. They have many uses for which no other means can substitute. The dirigibles in existence and proposed throughout the world.

Will it come back? Will it not come back? To judge from an international conference on lighter-than-air craft held recently in Paris, it will come back. The interest in the dirigible, discussion of which has periodically revived, is now increased by the oil situation. Indeed, the dirigible consumes very little of it.

True, it is slow; but why should a ton of industrial goods have to travel at the same speed as passengers in a hurry? What is more, the cost of operating a dirigible seems very competitive indeed, especially for those that can transport loads of more than 100 tons. This "ship of the air" enjoys the favor of the ecologists, since it produces less pollution and noise than the means of transportation used today.

Other advantages of the dirigible: vertical takeoff and landing, possibility of "fixed point" (that is, hovering in the air), and other characteristics that make it possible to avoid cargo breakdown because the aircraft permits "door-to-door" transport of indivisible or heavy loads. This results in simplification of distribution circuits and the possibility of building large units transportable without partial disassembly, with consequent reduction of production costs and maintenance expenses.

Since the surface facilities can be simple, the aircraft can be used to reach difficult zones, unexplored regions or places to be protected.

Since the demand for means of communication continues high, the problem is to adapt the various types to the most appropriate uses, in view of the fact that the current tendency is more toward diversification than toward multipurpose means.

Some recall with concern certain events of the past (the "Hindenburg" fire, for example); but it should be kept in mind that the dirigibles built today will enjoy advantages owing to technical and technological progress, which is considerable. Here are some examples:

--large-scale production of helium, a noninflammable inert gas that takes the place of hydrogen, which, as is known, is flammable;

--the great progress achieved in navigation and piloting systems with the recent development of microelectronics;

--the progress in the field of materials (especially as regards the gasbags);

--better knowledge of aerodynamic phenomena;

--better short-term and medium-term knowledge of weather conditions over large areas.

In most of the countries interested in revival of the dirigible (France, the United States, Japan, Canada, Great Britain), conventions have been entered into whose contents express agreement on certain uses, several of which are practically mandatory. Let us take a look at them.

The Flying Cranes

For the lifting and transport of heavy loads over short distances, the dirigibles would be a kind of "flying crane." Over longer distances, a big carrier would fill a niche that is presently vacant.

An example: in 1975, the USSR delivered to France a 17,000-ton hydraulic press, a colossus that made the trip across the Soviet Union to Issoire in separate component parts--in 14 months, 1,773 packages passed through Fos.

The train had to be used to Odessa, then ore ships with bridges strong enough to support the brackets (30 m long, 4 m high). At Fos, a rail line was specially built along the river bank, and 41 special trains had to go as far as Lyon and Dijon and then return to Issoire. Besides all this there were special road convoys and the various difficulties in loading and unloading at every transit point. It is certain that a lighter-than-air craft, suitable equipped, would have made for considerable saving of effort, time and money.

Among the High Mountain Forest

Advanced studies on possible uses in the forest sector have been carried out in France on a joint basis by the Technical Center for Wood and the National Forests Office. The problem concerns principally the transport of timber from the woods where it is felled to a road accessible to trucks. The helicopter is used today, but it has the double disadvantage of limited load capacity and excessive cost.

Unlogged forests on mountains are left to themselves, with the result that the trees are often too old and die without being replaced. This results in gradual erosion of the terrain, which runs the risk of becoming catastrophic if a solution is not found in the coming years.

Port Ferries

In recent years, a number of countries have experienced development that has led to an increase in importation and exportation. The jamming of ports that are poorly equipped, or not equipped at all, impedes trade exchanges. This is the case in Africa (Guinea, Liberia) and in the Persian Gulf, where there are waits of 40 or 50 days for unloading or loading cargo. A fleet of dirigibles could compensate for the insufficiency of the facilities by unloading goods from ships lying at anchor off the port.

A View From Above

In the area of surveillance, the dirigible offers a double advantage. It is capable of hovering still in the air, of course, and this makes it possible not only to observe but also to be seen, which is a considerable asset in missions of:

--pollution, surveillance of coastal zones;

--surveillance of territorial waters (200 miles off the coasts);

--surveillance and control of road traffic.

In the United States, the Coast Guard might need the dirigible for better surveillance of recreational boating, and the Air Force has proposed its use for monitoring movements near the Mexican border.

Several other uses could be listed. In the military field, lighter-than-air craft are already used intensively: in World War II, 90,000 ships crossed the Atlantic without any loss, escorted by dirigibles. Submarines were pinpointed as if they were fish, and the torpedo boats were immediately sent against them. The Germans were therefore prevented from taking action. Today, the U.S. Navy needs a means for landing assault vehicles and troops on coasts without landing facilities.

For the Developing Countries

Many developing countries are prepared to invest capital in order for the dirigible to become a reality. This is the case with the countries of Latin America, such as Brazil, that would like to exploit some regions presently inaccessible for want of a rail or road system. How can the material needed to build [illegible] in the middle of the Amazon forest be carried? How is aid to be brought when an earthquake isoloates a region, a city or a village from the rest of the world?

Venezuela recently ordered from Great Britain an AD 500, designed mainly to short-cruise maritime reconnaissance. The cabin has been designed and built by a French company that studied the project's aerostatic system. The AD 500 flew for the first time on 3 February of last year. The performance characteristics are modest: 2-ton payload, average speed 90 km per hour, 10-hour range, length 50 m, volume 5,000 m^3, two Porsche 100-HP engines, and two streamlined variable-pitch propellors with variable-direction thrust.

Hybrids Shaped Like Flying Saucers

It is not said that the new dirigibles will retain the cigar shape that we are familiar with. Within perhaps 2 or 3 years, the UFO's of the comic strips could become a reality. A British company has proposed a "Thermoskyship" that looks very much like a flying saucer. It is a hybrid aircraft, a bit of dirigible and a bit of helicopter. The climbing thrust is provided by helium, and two 1,400-HP double-flow turbojets give the horizontal thrust through variable-pitch nozzles positioned on the outside edge. In view of the carft's load-bearing shape, the lenticular hull (45 m diameter for a 6-ton aircraft) seems to give the craft better handling. While it has some defects (higher resistance, very poor aerodynamic efficiency, low stability), its advantages are decisive ones in the low-speed realm: outstanding habitability, aerostatic lift possibilities, large surface area making it possible to take advantage of the ground effect or "air cushion."

Since a surface area of 4,000 m^2 is sufficient for landing, the Thermoskyship will be able to go into city centers. Indeed, the principal use anticipated consists in linking two nearby urban centers, or a city and its airport. The English transportation company European Ferries has ordered two of these dirigibles to provide ferry service between London and the continent: it will take about 2 hours to reach Amsterdam.

There is another "dirigible saucer" that aroused discussion last winter: the "Flipper," which was damaged by the snow before its test flights. Born out of the "Pegasus" project on which the CNRS (National Center for Scientific Research, in France) had worked in the years 1970-1973, the Flipper was a kind of prototype that had the purpose of summarizing all the technological and industrial problems that this kind of project posed. The French group that had financed the project decided to build the "Alcyon I," a minidirigible derived directly from the Flipper.

Alcyon I, designed for surveillance, tourism and advertising, will also have a lenticular hull, of 6,300 m^3. Propulsion is by three internal-combustion engines, each coupled to two propellors--one of horizontal axis, for forward thrust, and the other of vertical axis, for landing. Fuel-consumption compensation is provided by condensation of the steam of the exhaust gases (combustion of 100 g of gasoline corresponds to formation of 140 g of steam). This approach has been tested on the American dirigibles Atron and Macon. There are also a balsa-wood and fiberglass nacelle and suction devices for landing. The vehicle can be put on the market for the price of 700 million lire.

There are presently more design proposals than actual construction, but in most cases, the designers maintain that transition to the construction phase could be rapid if the bostacles--mainly financial--are removed.

The Meteorological 'Minidirigibles'

The "Dinosaure"--another French minidirigible--is in the design phase at the request of the Meteorological Study and Research Establishment. The objectives are of three types:

--gathering of meteorological data from the lower strata of the atmosphere (temperature, humidity, wind);

--study of clouds and of the microphysics of very small droplets;

--study of atmospheric pollution: monitoring of diffusion of pollutant agents from their origin and of their transformation.

Use of the balloon and of the airplane in meteorology has many advantages, but both are less convenient than the dirigible. The Dinosaure makes it possible to combine the pilotability and variable lift of the airplane with the minimal disturbance of the environment, long range and low operational cost of the balloon.

The originality of the Dinosaure, for which both a piloted and a remote-controlled version are planned, lies in its two fish-bone trilobate hulls arranged like a catamaran and joined in the rear by a connecting surface composed of inflatable elements. The air-cushion landing devices make it possible to take off and land in a reduced area.

For Timber

In 1977 the French company Aerospatiale, reviving an idea advanced by the engineer Etienne Oehmichen in 1931, has proposed a project to solve the problem of transport of timber. It is a balloon equipped with two helicopter rotors and two tractive propellors, and it is called "Helicostat." This cross between the helicopter and the dirigible offers the advantages of both --in particular, considerable savings on operating costs because of the bigger payload at equal power as compared with the helicopter.

Studies have been carried out to reduce the costs of ground maintenance, with elimination of the hangar in particular, which--already of sizable dimensions in the case of the Helicostat A2-100--would become entirely prohibitive for craft of larger capacity. The aircraft proposed would require a surface area of 50 m X 30 m, with 8 anchoring points on the ground, under headwind conditions of 30 m/second and wind of 20 m/second from any direction. Since wind gusts of 30 m/second can be anticipated, the aircraft can be oriented appropriately. For long stops on land, and to resist winds of 40 m/second, the aircraft could be provided with a covering constituting an inflatable hangar. The new structure of the hull--called "fish-bone"-- and the presence of a central metallic core permit mooring of the craft at the ends. The operating cost per ton of timber transported would be 18,000 lire for a typical trip with ascent to 600 m and horizontal travel of 1,500 m; this would be half the cost by the traditional means.

A machine of this kind could also function as a port ferry, while on the basis of the A2-100, a family of larger Helicostats could be developed. The A2-100 is now defined in all particulars, and could go on to the construction phase.

According to a survey of the potential market (carried out by SODETEG [Technical Studies and General Enterprises Company] and Transconsult), there could be a range of dirigible between the 2.5-ton model and the 500-ton model for transport of loads. Before the bigger craft are built, the go-ahead would have to be given for building small models that would be intermediate stages for the purpose of perfecting the design, even though the bigger the dirigible, the more competitive the operating cost will be: 800 lire per ton-kilometer for a 25-ton model, 200 lire per ton-kilometer for a 500-ton model.

Solar Craft From England

One of the most original ideas comes from the British Isles. This is the "Sunship" project, which, as the name suggests, makes use of solar energy. The starting idea was to cover the dirigible's gas-bag--a large surface area --with solar cells to generate energy to power directly the electric motors that drive the propellors. Propulsion thus costs almost nothing. Speed could reach 120 km/hour during the period of exposure to the sun (from 6 to 10 hours per day). To be able to use the aircraft when there is no sun, it would be necessary to store energy, in the form of hydrogen obtained by electrolysis.

As regards propulsion, two possible approaches have been thought of: lateral propellors powered by 100-kW electric motors, or a peripheral propellor mounted on the rear part with a linear electric motor. For the solar cells, which will have to be protected by a thin transparent plastic film possessing adequate properties of reflection and transmission, there are also various possiblities: silicon, cadmium sulphide, gallium. The disadvantage of the cells is that they increase the weight of the craft; but since there is no fuel, the total weight would remain the same.

For use, the sun is necessary, not too much wind, and absence of high relief on the land (the Sunship would travel at about 100 m altitude). These conditions are encountered in those relatively undeveloped zones whose requirement for exploitation of their resources is precisely that of means of transportation. In Europe, mixed use--conventional engines--solar energy could be envisioned.

In the Japanese Islands

Research has been in progress for the last 3 years in Japan, under the aegis of the MITI (Ministry of International Trade and Industry), which has asked for $75 million for 6 years, starting in 1981, for development of lighter-than-air craft.

Mitsubishi Heavy Industries has proposed a craft entirely similar to the American Aerocrane: 4 wings with propellors that propel a balloon of 25 m diameter. With a 3-hour range, the balloon will be able to cover 150 km. Kawasaki seems to tend toward the "Helistat" formula, similar to the Helicostat: a conventional dirigible with four helicopter rotors. There is a very stable demand by the electric-power industry for transport and installation of pylons and power plants in mountainous country.

The Japanes foresee another possible use of the dirigible. Every year in their islands (of which there are 720), a large quantity of perishable foodstuffs is lost for lack of means of transport, and even more because of bad conditions on the sea. It is the same problem as in some less-developed countries, such as Sudan, where several tons of peanuts recently could not be transported from the southeast and rotted on the spot (Sudan has 800 km of asphalt roads and 20,000 km of tracks). Despite the fact that there are so many specific projects, some problem points still remain, even if none of them seems really insoluble.

The Obscure Points

The behavior of gases (transformation and exchanges) in large gas-bags is still not understood perfectly. The operations of loading and parking on the ground pose problems, as evidenced by the incident suffered by the AD 500. This dirigible is moored to a pole fixed on a vehicle. During a storm, the maintenance crew wanted to take the craft into its hangar. The winds whirling in the hangar caused the dirigible to be somehow skewered on its pole, with the result that tears were made in the gas-bag. The lenticular hull certainly permits better parking in the open air as compared with the conventional dirigible, since the wind-vane effect disappears with the saucer-dirigible.

For large-scale transporters of goods (ores, offhore equipment, etc), the difficulty lies in positioning over the material to be loaded. When the dirigible is not on the ground, the positioning has to be very accurate. If unloading can be done through openings in the central part, there is no problem, but if the use of containers is necessary, setting them down creates difficulties: it is out of the question for the aircraft, exposed to the wind, to oscillate vertically--during cargo break-bulk, for example. Therefore a special arrangement for mooring and guiding has to be perfected. Nor must we forget the effect of weather conditions, especially during take-off and landing. In an excessively turbulent atmosphere, the dirigible must regain altitutde and wait for conditions to improve before coming to ground.

Dirigibles and Their Potential Market

(SODETEG-Transconsult)

MINIDIRIGIBLE

Basic mission: surveillance and sighting, small-load transport, forest work

Range	1,000-2,000 km
Speed	20-150 km/hour
Short landing on temporary bases	
Flying altitude	500-1,000 m

Development time: 2 years
Market: 300 for Europe; 500 worldwide

SMALL DIRIGIBLE

Basic mission: servicing and unloading ships, surveillance, small-load transport, airplane-type work (spraying of fields with liquid fertilizer, oil exploration)

Characterstics	Work Version	Surveillance Version
Range	400-1,000 km	1,000-3,000 km
Speed	50-100 km/hour	100-120 km/hour
Payload	10-25 tons	10-20 tons
Flying Altitude	1,000-4,000 m	1,000 m
	stationary flight	slow flight
	vertical takeoff	short takeoff
	temporary base	fixed base

Development time: 4-5 years
Market: 200 for Europe; 500 worldwide

MEDIUM-SIZE DIRIGIBLE

Basic mission: transport and servicing (containers, prefabricated elements), transport of goods and passengers over medium distances

Characteristics	Work Version	Transport Version
Range	500-800 km	1,000-2,500 km
Speed	100 km/hour	100-120 km/hour
Payload	50-100 tons	80-100 tons
	stationary flight	short takeoff
	short takeoff	
	fixed main base	fixed base

Development time: 6-8 years. Market: 30-150 for Europe

HEAVY DIRIGIBLE

Basic mission: transport and servicing of heavy and bulky loads, heavy transport (ores, big industrial installations) over medium and long distance

Characteristics	Exceptional-Load Version	Heavy-Transport Version
Range	2,000 km	5,000 km
Speed	100 km/hour	150 km/hour
Payload	more than 250 tons	more than 250 tons
	stationary flight	
	short takeoff	short takeoff
	fixed main base	fixed main base

Development time: 8-12 years.   Market: 20-35 for Europe

Since the advantages offered by the dirigible are beyond question, the channels of use have been identified, and the techological problems are almost all solved, what is awaited before we go on from the present small-scale stage to industrial-scale production?

There seem to be two reasons. The cost of a program to build heavy transport dirigibles is considerable and cannot be borne by a single industrial group or by a single agency. A pool or a European cooperation program would have to be created.

If it is true that there are no problems of a scientific or technical type, there is, however, a problem of industrial tradition: the technologies related to dirigibles have to be taught and learned from scratch. The first investment to be made, the experts suggest, is to train a group of some 100 persons, in which the industries would participate and that would set itself the objective of first learning everything on the subject, and then going on to participate in development.

It will probably be necessary to begin with small craft, but it is really the big cargo-carrying dirigible that the international transport industry needs in order to reach its full development. The dirigible does not compete with the traditional means of transportation because it has its characteristic uses, and it should be viewed clearly by the economists and the ecologists, who will appreciate the fact that it can fly--perhaps within 10 years--a few meters above the African savannah without polluting the air and without making noise.

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FOKKER F 29 TO BE IN SERVICE BY 1985

Gelsenkirchen AEROKURIER in German Apr 80 p 465

[Text] The Fokker F 29 is to be able to carry 130 to 165 passengers and, according to the plans of the Dutch company, be available for service by 1985. The background story: It is common knowledge that Fokker had been busy for years with project studies for the successor to the F-28. The results of their research led to project "Super F-28," which was designed to carry a maximum of 115 passengers. As part of their comprehensive market research Fokker sales teams visited 25 airline companies in all parts of the world in the spring of 1979 to show them the planned Super F 28. As Fokker's market research showed, the airlines that had been approached were in favor of a larger machine with a capacity of 130 to 160 seats. But this exceeded the potential for expansion of the F 28. Fokker therefore decided to go ahead with a completely new project, the F 29. The F 29, the biggest airplane project ever undertaken by Fokker, is said to combine the newest findings in airplane construction. The present stage of planning calls for a twin-engined, wide-bodied (six seats per row), mid-wing plane, with the engines mounted under the wings and a T-shaped tailplane. Its principal characteristics are:

--advanced wing design (wing area 115 m^2, aspect ratio 10, sweepback 21°, wing span 34 meters, the use of new

--lightweight composite construction materials

--digital flight controls and

--being fitted with the most up-to-date engines, such as the Rolls-Royce RB432-05 or General Electric/Snecma CFM56-3.

On the basis of this draft Fokker calculates a reduction in fuel consumption of about 25 percent in comparison with contemporary airplanes in the size range of 150 to 200 seats. Direct operating costs on a seat-per-mile basis are said to be at least 10 percent less than comparable contemporary airplanes. Fokker estimates takeoff weight to be 58,000 kilos. Takeoff distance at maximum weight and under normal conditions will be 1,375 meters. Cruising speed of the F 29 is given by Fokker as Mach 0.75, and maximum range with a full passenger load as 2,275 km. Following the F 27 and F 28 Fokker expects a long production run, which could well last beyond the turn of the century.

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